

# Chlorine And Its Properties



*Disinfection Products*

## General

Chlorine is one of the most common chemical elements. Because of its reactive nature, it is never found in a free elemental state in nature, however, many compounds of chlorine are found. The most common is sodium chloride (common table salt).

Chlorine is usually manufactured commercially by passing an electric current through a water solution of sodium chloride (commonly called brine). The brine is converted to free chlorine gas and caustic soda. Commercially, chlorine is available as a liquefied gas under pressure and supplied in 100 or 150 pound cylinders, 2000 pound (ton) containers, railroad tank cars, barges, and, occasionally, in tank trucks.

Chlorine is very active chemically and combines with both metals and non-metals. It will react rapidly with almost all the elements and with many inorganic compounds and more slowly with organic compounds. Chlorine gas is greenish-yellow in color and chlorine liquid is clear amber. The odor of chlorine is very irritating and penetrating and can be detected as low as 3 ppm/vol.

## Properties

Chlorine gas is about two and one-half times heavier than air. Therefore, any chlorine leak will seek the lowest level. Liquid chlorine (not water chlorine solution) freezes at about -150°F (-100°C) and boils at approximately -30°F (-34°C). Dry chlorine in the liquid and gaseous stage is not corrosive to many common metals such as steel and brass but is extremely corrosive when moisture is present. Thus, steel cylinders and brass valves are used for storing and shipping chlorine following Chlorine Institute approved methods and materials. Chlorine manufacturers and repackagers are careful to ensure the chlorine in the containers is dry (<150 ppm by volume).

Chlorine gas and liquid are non-explosive and non-flammable. Chlorine can support combustion of certain substances (e.g. iron at 483°F (250.6°C)). Thus, any piping that was used for chlorine must be thoroughly cleaned before welding or cutting the pipe with a torch.

**NOTE:** For further data on chlorine, write or call The Chlorine Institute, Inc., 2001 L Street, N.W., Washington, DC 20036, Tel: 202-775-2790 or Fax: 202-228-7225.

## Table I - Chlorine Properties

**Boiling Point** — 29.29°F (-34.05°C) at 1 atmosphere

**Freezing Point** (or melting point) — -149.76°F (-100.98°C) at 1 atmosphere

**Density** — Dry Gas 0.2006 lb/ft.<sup>3</sup> (3.213 kg/m<sup>3</sup>) at standard temperature and pressure  
Dry Liquid 91.6 lb/ft.<sup>3</sup> (1,468 kg/m<sup>3</sup>) at 32°F (0°C)

**Heat of Vaporization** — 123.7 BTU/lb. (68.7 gcal/g) at boiling point of -29.29°F (-34.05°C)

**Specific Heat Dry Gas** — 0.113 BTU/lb./°F (0.113 gcal/g/°C) at 100 psia or less and 30°F to 80°F  
(-1.1°C to 26.7°C)

**Solubility in Water** — 1% at 50°F (10°C) approximate; 0.5% at 100 °F (37.8°C) approximate

**Maximum Allowable Concentration** — 1 ppm/vol

**Molecular Weight** — 71 g/mole

**Threshold Odor Level** — 0.02 to 0.2 ppm (varies with individuals)

**AGCIH\* 8-Hour TWA\*** — 0.5

(TWA - Time Weighted Average)

(ACGIH - American Conference of Governmental Industrial Hygienists)

**LC<sub>50</sub> (Gas)** — 293 ppm/vol

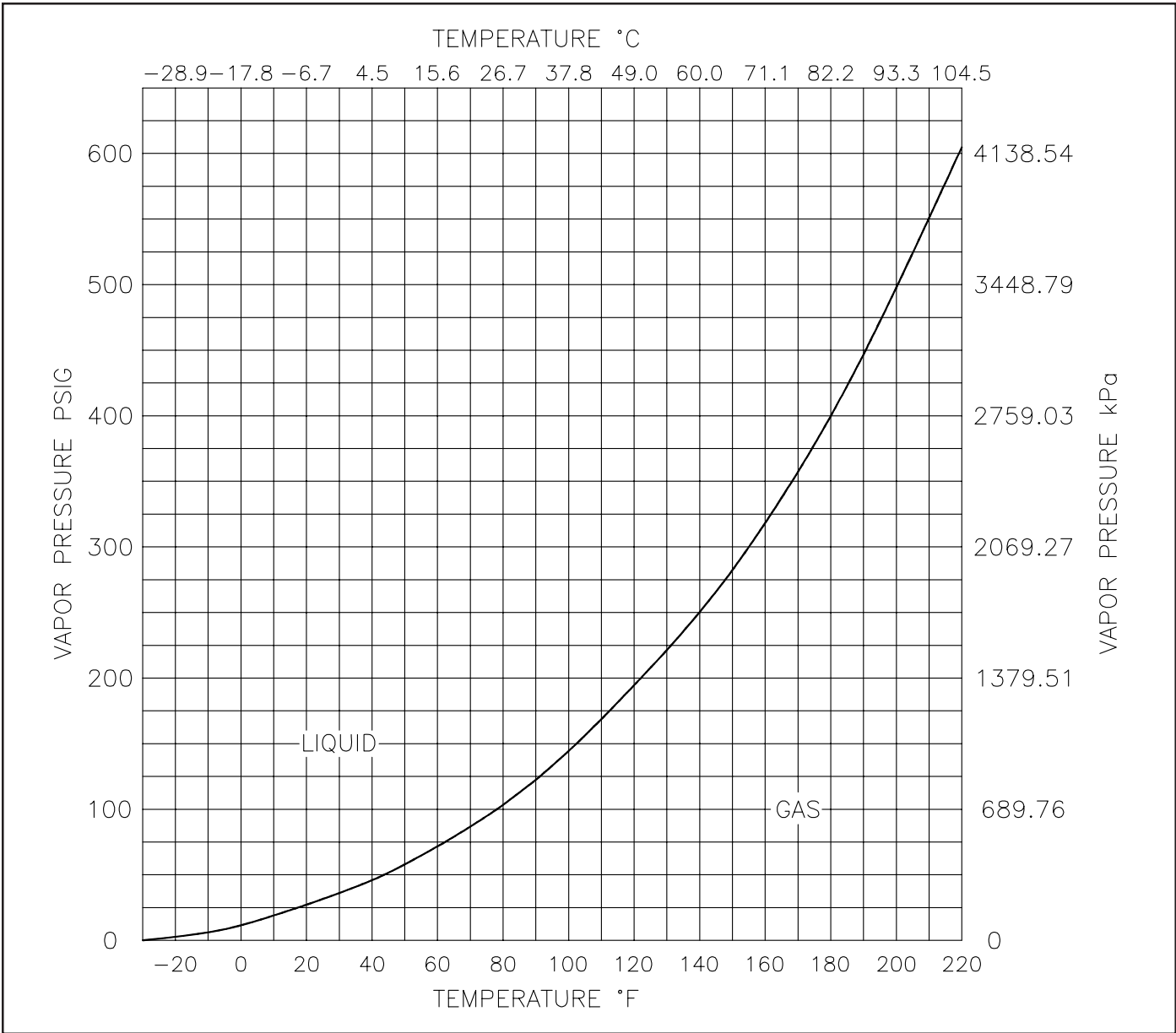


Figure 1 - Vapor Pressure of Liquid Chlorine

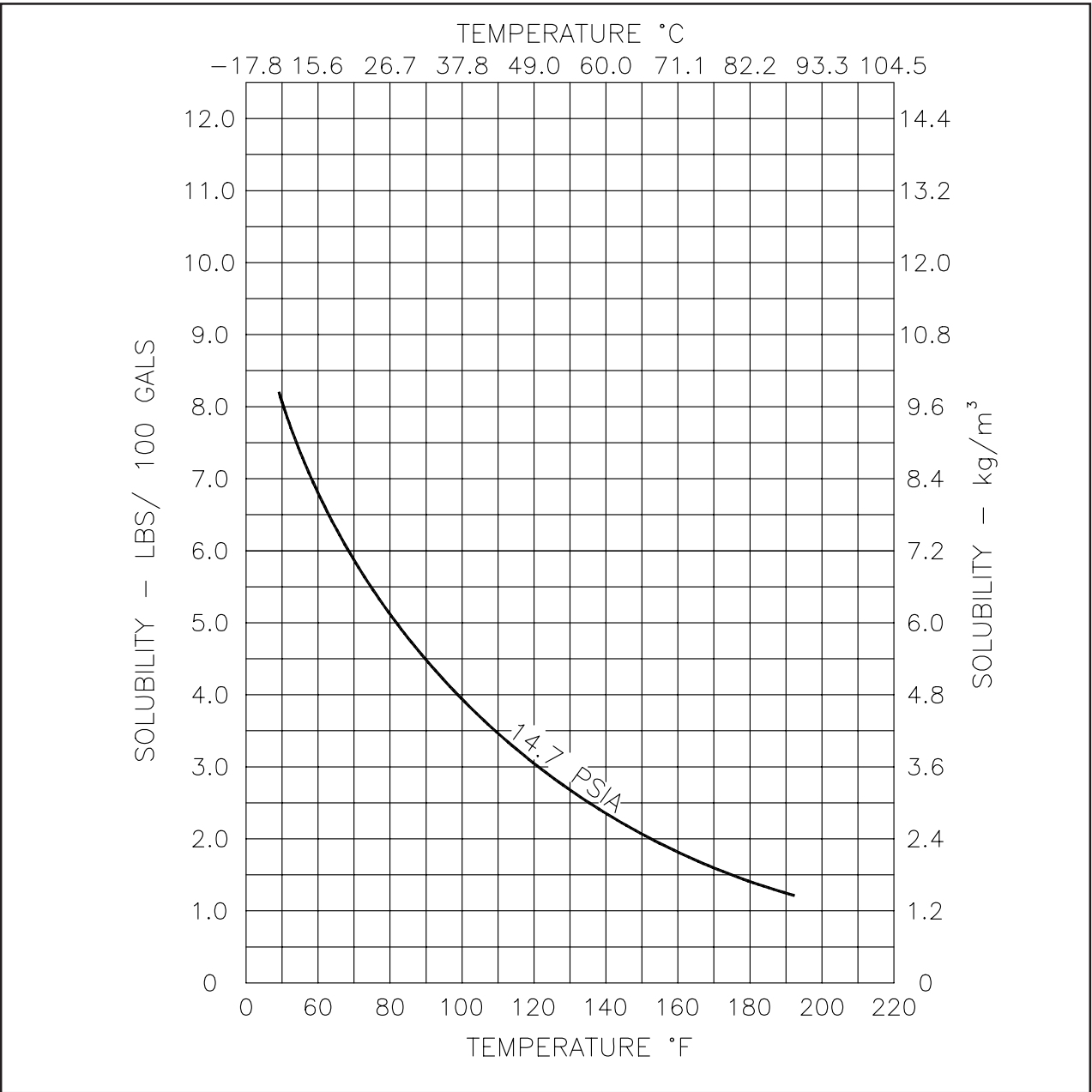


Figure 2 - Solubility of Chlorine in Water

References:

1. Source for illustrations and data are the Chlorine Institute Manual.
2. Chlorine Institute pamphlet 65.
3. Bulletin 010.3215 - Chlorine Supply Containers and Piping
4. Bulletin 010.3220 - Removal of Gaseous Chlorine From Containers
5. Bulletin 010.3002 - Chlorine Reliquefaction, Condensation and Flashing
6. Bulletin 010.3210 - Safe Handling of Chlorine Gas

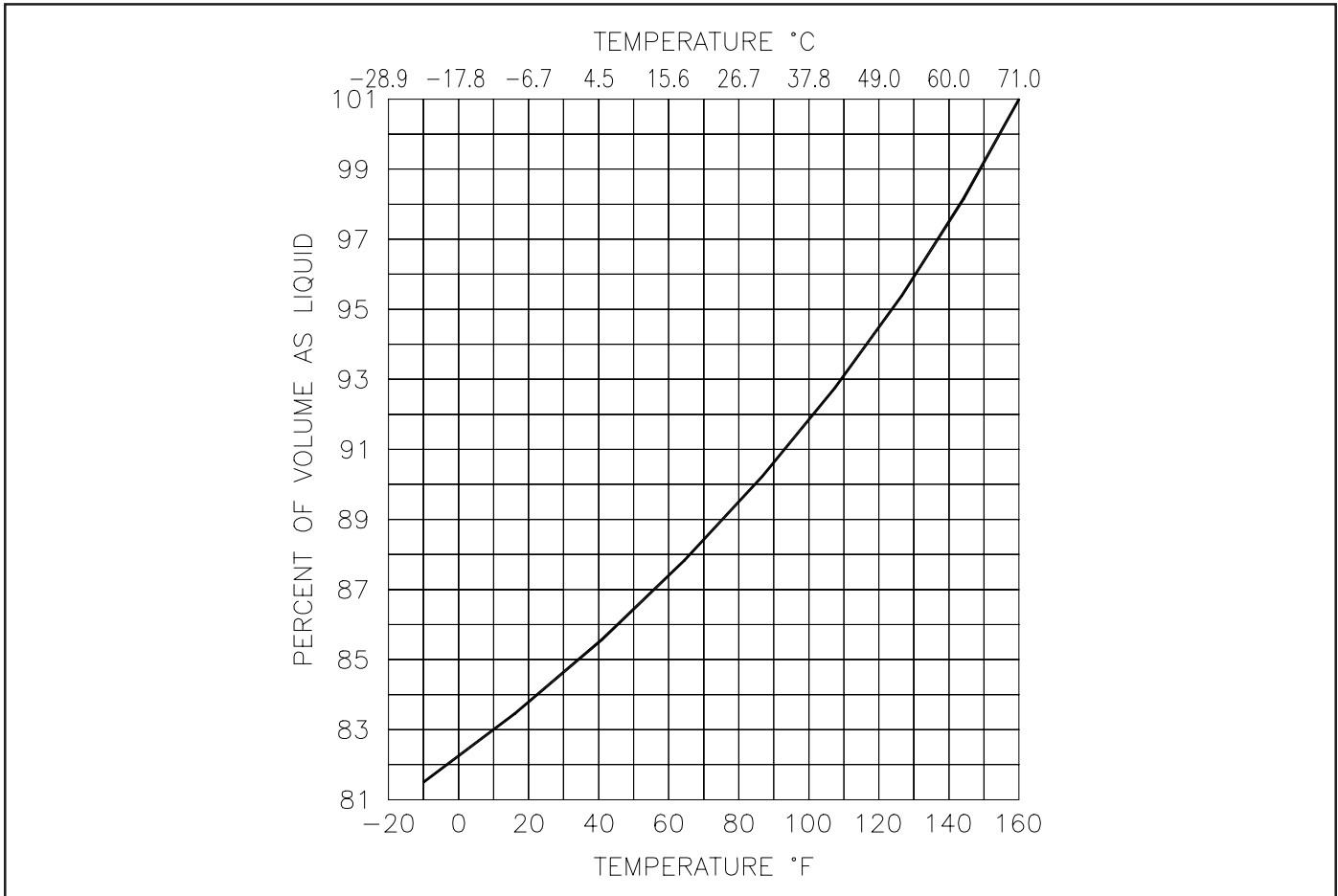


Figure 3 - Volume-Temperature Relationship of Liquid Chlorine

Design improvements may be made without notice.

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